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Re: Publication no. 20040055563
Patent application no. 10/643274

Request refund of all money that I have been or will be charged for Publication no. 20040055563.

The publication has changed my application's content so much that it cannot be understood. It is useless. The attached copies of pages 5,6,9 have examples, some with highlights. For comparison, a second attachment has copies of the way I submitted the examples in the patent application.

The application includes a very important mathematical explanation for why it is impossible to make the crankshaft engine fuel efficient and why my patent pending engine application no. 10/643274 will be fuel efficient. Without this proof, I have not been able to convince engineers of this fact. The math has already been reviewed by at least 2 separate practicing engineers and found to be correct.

The publication changed the mathematical language to text words and in some places it cannot be deciphered even by me and I wrote it, e.g. attached highlighted: [0020] "Cos 101 equations"; [0035] lines 4,5 "1 Lim C 0.0 o s = 1.0 ." and paragraph [0036] should follow on the same line 5. [0100] "bore = 2 {square root}{square root over (F/(.pi.F'))".

The drawings that are referenced in the text are all missing. In speaking to a PTO rep, I understood her to say that the drawings are in the "images". I went to "images" on my computer and every page of no. 20040055563 was blank. I found a heading, "Published Application Full Page Images". The following excerpts were in it: "Tagged Image File Format. However, there are many variants - - or "flavors" - - of TIFF, etc. Displaying them requires either a TIFF G4 plug-in for your browser, etc. Note that relatively few image viewers and plug-ins handle G4 compression, etc.". Does anybody understand that? I don't and neither does my associate who informed me of it.

What is the benefit of your changed publication if engineers for whom it is intended cannot understand it? A correct copy of the application with all the amendments is on my website www.abetterengine.com. The important math is in it unchanged. Why won't you publish it correctly? What is the purpose of including a cost to me for your useless publication?

R.L. Giuliani

R.L. GIULIANI
Inventor/Applicant

2 attachments
attch I
attch II

[0013] For instance, when .alpha.=10.degree., M/a=11.49:1. At this point, the rod's slow crank end must go 11.49 times as far as the piston. The slower the crank's rotation, the longer the gases are trapped in a small chamber and the lower the engine's efficiency. It is known that this is where the confined hot, pressurized gases create most of the pollution and waste heat. The crank's angular efficiency:

[0014] Cos .theta.=FV2/FV1

[0015] Cos .PHI.=FV3/FV2

[0016] FV2=FV1(Cos .theta.)

[0017] FV2=FV3/Cos .PHI.

[0018] FV3=FV1(Cos .theta.)(Cos .PHI.)

[0019] FV3/FV1=(Cos .theta.)(Cos .PHI.) Crank engine's angular efficiency. It caps the burn efficiency.

[0020] FIG. 14 is also the basis for the following indented equations that lead to the Cos .theta. and Cos 101 equations in terms of crank angle .alpha., length L and crank arm r:

[0021] 180-.beta.=.gamma.

[0022] .gamma.+.theta.+.PHI.=180

[0023] .beta.=90-.alpha. Note the rt. triangle (.alpha.+.beta.+90)

[0024] 180-(90-.alpha.)=.gamma. or 90+.alpha.=.gamma.

[0025] (90+.alpha.)+.theta.+.PHI.=180

[0026] .alpha.+.theta.+.PHI.=90

[0027] n=r Sin .alpha.

[0028] Sin .theta.=(r/L)Sin .alpha.

[0029] .theta.=Sin.sup.-1[(r/L)Sin .alpha.]

[0030] Cos .theta.=Cos {Sin.sup.-1[(r/L)Sin .alpha.]}

[0031] .alpha.+Sin.sup.-1[(r/L)Sin .alpha.]+.PHI.=90

[0032] .PHI.=90{.alpha.+Sin.sup.-1[(r/L)Sin .alpha.]}

[0033] Cos .PHI.=Cos(90-{.alpha.+Sin.sup.-1[(r/L)Sin .alpha.]})

[0034] The equations Cos .theta., Cos .PHI.0 are easily solved with a hand calculator. For instance, they give the angular efficiency=22.4% when .alpha.=10.degree.; r=1.5"; L=5.0". Since the burn efficiency is low (See M/a above) the total efficiency has to be much less than 22.4% in this example. The efficiency increases as .alpha. increases but the combustion pressure decreases as .alpha. increases. A higher rpm

attch I

increases efficiency but that has reached its limit and it is not good enough.

[0035] The importance of angle .theta.=Tan.sup.-1r/L now follows. That is when FV2 is tangent to the circle d at the arm r which makes angle .PHI.=0.0 and Cos .PHI.=1.0. The angular efficiency is Cos .theta.=Cos(Tan.sup.-1r/L). In the example above where r=1.5"; L=5.0"; FV3/FV1=Cos .theta.=95.8.degree./. Extend L relative to r so that angle .theta. goes to 0.0. Then 1 Lim C 0.0 o s = 1.0.

[0036] (This is the foundation for differential calculus). That makes the angular efficiency FV3/FV1= (Cos .theta.)(Cos .PHI.)=(1)(1)=100% because there is no angular resistance since the angles .theta., .PHI. disappear. The variable angle .alpha. disappears. The crank arm r disappears. The variable length torque arm n (FIG. 14) which requires torque buildup is replaced by the fixed length torque arm r' (FIG. 15) which gives instant peak torque.

[0037] Unlike the crank, FV1 in this invention (FIG. 15) is always directed to rotating the output shaft 8 rather than directed against the shaft's bearings. FV1 is transmitted with both angles .theta., .PHI.=0.0 through the entire power stroke. The M/a=1:1 through the entire stroke. The circumference d' replaces the crank circle d in FIG. 14. Motion is transmitted through the fixed length torque arm r' to the output shaft 8.

BRIEF SUMMARY OF THE INVENTION

[0038] This is a high torque power, fuel-efficient engine that can be easily switched between a 2-stroke and a 4-stroke. A pair of combustion cylinders and their related pairs of parts, including 1-way clutches, are connected by an idler gear to make the basic 2-stroke engine. A third idler connects two pairs to make a 4-stroke engine. Computer controlled ignition allows power stroke overlap by equally spaced-apart applied power. The crankshaft is replaced by a straight power shaft.

[0039] A rugged 1-way clutch transmits power between the power piston and the output shaft. The piston is offset from the shaft's axis by the radius of the 1-way clutch at the point where it engages the piston connecting rod. Though conventional 1-way clutches will work, many are inefficient because they transmit motion between the races through two vectors. One vector is parallel to the clutch radial, which does not transmit motion. Instead, its energy is converted to waste heat that can contribute to early clutch failure. A preferred 1-way clutch that efficiently transmits torque between its races perpendicular to a clutch radial is described below with reference to FIGS. 7-13.

[0040] The math below can be used to calculate important values in designing a 2-stroke and a 4-stroke.

[0041] Objects of this invention include:

[0042] 1. easily interchanged between 2-stroke and 4-stroke;

[0043] 2. low cylinder expansion rate with a small bore, which allows more complete combustion of a small combustion charge resulting in high fuel efficiency;

[0044] 3. instant peak torque at the beginning of the power stroke;

[0045] 4. the 1-way clutch overrun feature allows deactivating pairs of pistons without load on the shaft;

[0046] 5. reduced mass engine compared to a crank engine;

[0090] Vp=.pi.(r')(Rv)/(30) Piston rod's speed and the 1-way clutch rim speed are equal at contact.

[0091] r'=60(Vp)/2.pi.(Rv)=30(Vp)/.pi.(Rv) r' is central to this engine's design and operation.

[0092] Rv=30(Vp)/.pi.r'

[0093] Sp=550 hp(1+Lo)

[0094] Fr=(Sp)/(778Qc)

[0095] Fr=(F)(n.sup.2)(Vp)/[2(778)(Qc)] For a 2-Stroke

[0096] F=2Sp/(n.sup.2Vp) For a 2-Stroke

[0097] T=F(r')

[0098] F'=F/[.pi.(r.sub.b.sup.2)]

[0099] r.sub.b.sup.2=F/(.pi.F')

[0100] bore=2{square root}{square root over (F/(.pi.F'))}

[0101] The advantage of overlap is evident in the next two examples that compare the number of cylinders in this smaller engine with the number of cylinders in a crank engine of equal power. The examples also show the power advantage of this engine's overlapping 2-stroke over its 4-stroke.

[0102] 1. Example of this 2-stroke engine with n cyls. vs. the number of crank engine cyls. of equal power:

[0103] Let n=6 then n.sup.2/2=18 crank engine cyls.

[0104] 2. Example of this 4-stroke engine with n cyls. vs. the number of crank engine cyls of equal power:

[0105] Let n=8 (two banks of 4 pistons each in FIG. 6) then n.sup.2/4=16 crank engine cyls.

[0106] The deactivation feature also makes a 4-Stroke bank combined with 2-Stroke pairs advantageous.

[0107] Discussion.

[0108] A pair of combustion cylinders 33 and related pairs of parts that include a pair of 1-way clutches (FIGS. 1-3) make the basic 2-stroke engine in this invention. The clutch's inner race 4 is keyed to the power shaft 8. The outer race 5 carries a sector gear 12. Each gear 12 engages an opposite side of idler 40 whereby synchronous reverse motion is transmitted between the power piston 38 to the second piston 38 in the pair as the inner race 4 transmits the power to the shaft 8. Moving parts that are not shown with arrows 42 are presumed obvious.

[0109] Combining two pairs with idler 40A creates a 4-stroke shown in FIG. 6 that will be described later under Interchanging 4-Stroke and 2-Stroke.

The crank engine's efficiency is zero at tdc when angle $\theta = 0^o$ but angle $\Phi = 90^o$, making **FV3** = **FV1(1)(0)** = **0**. <u>When **FV2** is tangent to circle **d**</u>, $\mathbf{Cos\ \Phi = 1.0}$ and $\mathbf{Tan\ \theta = r/L}$ and $\mathbf{\theta = Tan^{-1} r/L}$ from which $\mathbf{Cos\ \theta}$ is found. The efficiency at that point is $\mathbf{FV3/FV1 = Cos\ \theta}$. The importance of angle $\theta = \mathbf{Tan^{-1} r/L}$ will be shown below.

The ratio of the displacement **M** along the crank circle **d** to the piston's displacement **a** at any chosen crank angle α is easily found from FIG 16. **r** is the crank arm length and α is in degrees:

$$\mathbf{r = b + a}$$

$$\mathbf{a = r(1\text{-}Cos\ \alpha)}$$

$$\mathbf{M = \pi\alpha r/180}$$

$$\mathbf{M/a = \pi\alpha/[180(1\text{-}Cos\ \alpha)]}$$

For instance, when $\mathbf{\alpha = 10^o}$, **M/a = 11.49:1.** At this point, the rod's slow crank end must go **11.49** times as far as the piston. The slower the crank's rotation, the longer the gases are trapped in a small chamber and the lower the engine's efficiency. It is known that this is where the confined hot, pressurized gases create most of the pollution and waste heat. The crank's angular efficiency:

$$\mathbf{Cos\ \theta = FV2/FV1}$$

$$\mathbf{Cos\ \Phi = FV3/FV2}$$

$$\mathbf{FV2 = FV1(Cos\ \theta)}$$

$$\mathbf{FV2 = FV3/Cos\ \Phi}$$

$$\mathbf{FV3 = FV1(Cos\ \theta)(Cos\ \Phi)}$$

$\mathbf{FV3/FV1 = (Cos\ \theta)(Cos\ \Phi)}$ Crank engine's angular efficiency. It caps the burn efficiency.

FIG 14 is also the basis for the following indented equations that lead to the $\mathbf{Cos\ \theta}$ and $\mathbf{Cos\ \Phi}$ equations in terms of crank angle α, length **L** and crank arm **r**:

$$\mathbf{180 - \beta = \gamma}$$

$$\mathbf{\gamma + \theta + \Phi = 180}$$

$$\mathbf{\beta = 90 - \alpha} \qquad \text{Note the rt. triangle } (\alpha + \beta + 90)$$

$$\mathbf{180 - (90 - \alpha) = \gamma \text{ or } 90 + \alpha = \gamma}$$

$$\mathbf{(90 + \alpha) + \theta + \Phi = 180}$$

attch II

$\alpha + \theta + \Phi = 90$

$n = r \, \mathrm{Sin}\, \alpha$

$\mathrm{Sin}\, \theta = (r/L)\mathrm{Sin}\, \alpha$

$\theta = \mathrm{Sin}^{-1}[(r/L)\mathrm{Sin}\, \alpha]$

$\mathrm{Cos}\, \theta = \mathrm{Cos}\{\mathrm{Sin}^{-1}[(r/L)\mathrm{Sin}\, \alpha]\}$

$\alpha + \mathrm{Sin}^{-1}[(r/L)\mathrm{Sin}\, \alpha] + \Phi = 90$

$\Phi = 90 - \{\alpha + \mathrm{Sin}^{-1}[(r/L)\mathrm{Sin}\, \alpha]\}$

$\mathrm{Cos}\, \Phi = \mathrm{Cos}(90 - \{\alpha + \mathrm{Sin}^{-1}[(r/L)\mathrm{Sin}\, \alpha]\})$

The equations **Cos θ, Cos Φ** are easily solved with a hand calculator. For instance, they give the *angular efficiency* = **22.4%** when **α = 10°; r = 1.5"**; **L = 5.0"**. Since the *burn efficiency* is low (See **M/a** above) the *total efficiency* has to be much less than **22.4%** in this example. The efficiency increases as **α** increases but the combustion pressure decreases as **α** increases. A higher rpm increases efficiency but that has reached its limit and it is not good enough.

The importance of angle **θ = Tan^{-1}r/L** now follows. That is when **FV2** is tangent to the circle **d** at the arm **r** which makes angle **Φ = 0.0** and **Cos Φ = 1.0**. The *angular efficiency* is **Cos θ = Cos(Tan^{-1}r/L).** In the example above where **r = 1.5"**; **L = 5.0"**; **FV3/FV1 = Cos θ = 95.8%.** Extend **L** relative to **r** so that angle **θ** goes to **0.0.** Then $\lim_{\theta \to 0.0} \mathrm{Cos}\, \theta = 1.0$. (This is the foundation for differential calculus). That makes the *angular efficiency* **FV3/FV1 = (Cos θ)(Cos Φ) = (1)(1) = 100%** because there is no angular resistance since the angles **θ,Φ** disappear. The variable angle **α** disappears. The crank arm **r** disappears. The variable length torque arm **n** (FIG 14) which requires torque buildup is replaced by the fixed length torque arm **r'** (FIG 15) which gives instant peak torque.

Unlike the crank, **FV1** in this invention (FIG 15) is always directed to rotating the output shaft **8** rather than directed against the shaft's bearings. **FV1** is transmitted with both angles **θ,Φ = 0.0** through the entire power stroke. The **M/a = 1:1** through the entire stroke. The circumference **d'** replaces the crank circle **d** in FIG 14. Motion is transmitted through the fixed length torque arm **r'** to the output shaft 8.

Lo – Power losses (fraction of hp)

n – total number of pistons. 2,4,6, …

n/2 – 2 stroke. Number of equally spaced overlapping pistons cycling through the power stroke.

$\mathbf{n^2/2}$ – 2-stroke shaft power. (ft-lbf/sec).

n/4 – 4-stroke. Number of equally spaced overlapping pistons cycling through the power stroke.

$\mathbf{n^2/4}$ – 4-stroke shaft power. (ft-lbf/sec) See FIG 6.

Qc – fuel's energy density. (BTU/lbm).

r′ – 1-way clutch radius at connecting rod contact. (ft). See FIG 15.

$\mathbf{r_b}$ – radius of cylinder. (in)

Rv – power shaft's rotation rate. (rpm)

Sp – shaft power + losses. (ft-lbf/sec.)

T – shaft torque. (lbf-ft)

Vp – piston's velocity. (ft/sec)

Equations:

$\mathbf{Vp = \pi(r')(Rv)/(30)}$ Piston rod's speed and the 1-way clutch rim speed are equal at contact.

$\mathbf{r' = 60(Vp)/2\pi(Rv) = 30(Vp)/\pi(Rv)}$ **r′** is central to this engine's design and operation.

$\mathbf{Rv = 30(Vp)/\pi r'}$

$\mathbf{Sp = 550hp(1 + Lo)}$

$\mathbf{Fr = (Sp)/(778Qc)}$

$\mathbf{Fr = (F)(n^2)(Vp)/[2(778)(Qc)]}$ **For a 2-Stroke**

$\mathbf{F = 2Sp/(n^2Vp)}$ **For a 2-Stroke**

$\mathbf{T = F(r')}$

$\mathbf{F' = F/[\pi(r_b^2)]}$

$\mathbf{r_b^2 = F/(\pi F')}$

$\mathbf{bore = 2\sqrt{F/(\pi F')}}$

The advantage of overlap is evident in the next two examples that compare the number of cylinders in this smaller engine with the number of cylinders in a crank engine of equal power. The examples also show the power advantage of this engine's overlapping 2-stroke over its 4-stroke.

1. Example of this 2-stroke engine with **n** cyls. vs. the number of crank engine cyls. of equal power:

   Let **n** = 6 then $\mathbf{n^2/2}$ = 18 crank engine cyls.

2. Example of this 4-stroke engine with **n** cyls. vs. the number of crank engine cyls of equal power:

   Let **n** = 8 (two banks of 4 pistons each in FIG 6) then $\mathbf{n^2/4}$ = 16 crank engine cyls.